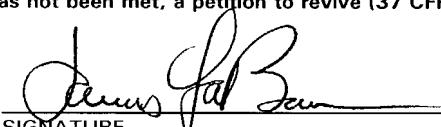


JCI07RAGdPOU/PTC 07 MAR 2002

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|--|---|---|
| U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE<br><small>(Rev. 9)</small>   |   | ATTORNEY'S DOCKET NUMBER<br>032326-200  |
| <b>TRANSMITTAL LETTER TO THE UNITED STATES<br/>DESIGNATED/ELECTED OFFICE (DO/EO/US)<br/>CONCERNING A FILING UNDER 35 U.S.C. 371</b>  |   | U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)<br>10/070504<br>Unassigned |
| INTERNATIONAL APPLICATION NO.<br>PCT/FR00/02380  | INTERNATIONAL FILING DATE<br>25 August 2000 | PRIORITY DATE CLAIMED<br>7 September 1999                                     |
| TITLE OF INVENTION<br>ELECTRONIC CARD COMPRISING IN STORAGE ITS BEARER'S IDENTIFICATION  |   |   |
| APPLICANT(S) FOR DO/EO/US<br>Jean-Christophe FIDALGO   |   |   |
| Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:  |   |   |
| <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li><input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.</li> <li><input type="checkbox"/> The US has been elected by the expiration of 19 months from the priority date (Article 31).</li> <li><input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2))             <ol style="list-style-type: none"> <li><input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau).</li> <li><input checked="" type="checkbox"/> has been communicated by the International Bureau.</li> <li><input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US).</li> </ol> </li> <li><input checked="" type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2))             <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> is attached hereto.</li> <li><input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4).</li> </ol> </li> <li><input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))             <ol style="list-style-type: none"> <li><input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau).</li> <li><input type="checkbox"/> have been communicated by the International Bureau.</li> <li><input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired.</li> <li><input checked="" type="checkbox"/> have not been made and will not be made.</li> </ol> </li> <li><input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li><input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li><input checked="" type="checkbox"/> An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol> |   |   |
| Items 11 to 20 below concern document(s) or information included:  |   |   |
| <ol style="list-style-type: none"> <li><input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98.</li> <li><input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li><input checked="" type="checkbox"/> A FIRST preliminary amendment.</li> <li><input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.</li> <li><input type="checkbox"/> A substitute specification.</li> <li><input type="checkbox"/> A change of power of attorney and/or address letter.</li> <li><input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.</li> <li><input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4).</li> <li><input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).</li> <li><input type="checkbox"/> Other items or information:</li> </ol>   |   |   |



21839

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|---|--------------|--|--|
| U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)<br>Unassigned <b>10/070504</b>   |              | INTERNATIONAL APPLICATION NO.<br>PCT/FR00/02380              | ATTORNEY'S DOCKET NUMBER<br>032326-200 |
| 21. <input checked="" type="checkbox"/> The following fees are submitted:   |              | CALCULATIONS   | PTO USE ONLY                           |
| <b>Basic National Fee (37 CFR 1.492(a)(1)-(5)):</b>   |              |  |  |
| Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO ..... \$1,040.00 (960)                          |              |  |  |
| International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... \$890.00 (970)  |              |  |  |
| International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$740.00 (958)   |              |  |  |
| International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) ..... \$710.00 (956)  |              |  |  |
| International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) ..... \$100.00 (962)  |              |  |  |
| <b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>   |              | \$ 890.00  |  |
| Surcharge of <b>\$130.00 (154)</b> for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492(e)).  |              | 20 <input type="checkbox"/> 30 <input type="checkbox"/>      | \$ -0-                                 |
| Claims  | Number Filed | Number Extra   | Rate                                   |
| Total Claims  | 13 -20 =     | -0-  | X\$18.00 (966)                         |
| Independent Claims  | 2 -3 =       | -0-  | X\$84.00 (964)                         |
| Multiple dependent claim(s) (if applicable)   |              | +\$280.00 (968)  |  |
| <b>TOTAL OF ABOVE CALCULATIONS =</b>  |              | \$ 890.00  |  |
| Reduction for 1/2 for filing by small entity, if applicable (see below).  |              | + \$ -0-   | -                                      |
| <b>SUBTOTAL =</b>   |              | \$ 890.00  |  |
| Processing fee of <b>\$130.00 (156)</b> for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)).   |              | 20 <input type="checkbox"/> 30 <input type="checkbox"/><br>+ | \$ -0-                                 |
| <b>TOTAL NATIONAL FEE =</b>   |              | \$ -0-   |  |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 (581) per property  |              | + \$ -0-   |  |
| <b>TOTAL FEES ENCLOSED =</b>  |              | \$ 890.00  |  |
|   |              | <b>Amount to be refunded:</b> \$                             |  |
|   |              | <b>charged:</b> \$   |  |
| a. <input type="checkbox"/> Small entity status is hereby claimed.  |              |  |  |
| b. <input checked="" type="checkbox"/> A check in the amount of \$ <u>890.00</u> to cover the above fees is enclosed.   |              |  |  |
| c. <input type="checkbox"/> Please charge my Deposit Account No. <u>02-4800</u> in the amount of \$__ to cover the above fees. A duplicate copy of this sheet is enclosed.  |              |  |  |
| d. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>02-4800</u> . A duplicate copy of this sheet is enclosed. |              |  |  |
| NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.                                       |              |  |  |
| SEND ALL CORRESPONDENCE TO:   |              |  |  |
| James A. LaBarre<br>BURNS, DOANE, SWECKER & MATHIS, L.L.P.<br>P.O. Box 1404<br>Alexandria, Virginia 22313-1404<br>(703) 836-6620  |              |  |  |
| <br>SIGNATURE   |              |  |  |
| James A. LaBarre<br>NAME  |              |  |  |
| 28,632<br>REGISTRATION NUMBER   |              | March 7, 2002<br>DATE  |  |

Patent  
Attorney's Docket No. 032326-200

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent Application of )  
Jean-Christophe FIDALGO ) Group Art Unit: Unassigned  
Application No.: Unassigned ) Examiner: Unassigned  
Filed: March 7, 2002 )  
For: ELECTRONIC CARD COMPRISING )  
IN STORAGE ITS BEARER'S )  
IDENTIFICATION )

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Prior to examination and the calculation of filing fees, kindly amend the above-identified application as follows:

**IN THE SPECIFICATION:**

Page 1, immediately following the title appearing on lines 1-2, insert the following:

--This disclosure is based upon French Application No. 99/11399, filed on September 7, 1999 and International Application No. PCT/FR00/02380, filed August 25, 2000, which was published on March 15, 2001 in a language other than English, the contents of which are incorporated herein by reference.

**Background of the Invention--**

Application No. Unassigned  
Attorney's Docket No. 032326-200  
Page 2

Page 3, before line 28, insert the following heading:

--**Summary of the Invention**--

Page 8, before line 25, insert the following heading:

--**Brief Description of the Drawings**--

Page 9, before line 7, insert the following heading:

--**Description of the Invention**--

Add the following Abstract:

--An electronic card with non-volatile storage that stores the card bearer's identification characteristics, for comparison of the stored characteristics with characteristics introduced during an authenticating sequence. Dynamic signature characteristics of the bearer are stored in the non-volatile storage. The card further comprises a zone for producing a signature to be authenticated, and a processor for supplying dynamic characteristics of the signature, a comparator for comparing the signature dynamic characteristics with the characteristics recorded in the non-volatile storage, and a power supply for the processor and/or the comparator outside a reader designed for reading data in the card.--

**IN THE CLAIMS:**

Kindly replace claims 1-13, as follows.

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Attorney's Docket No. 032326-200  
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1. (Amended) An electronic card comprising a permanent memory in which there are stored dynamic characteristics of the signature of a holder of the card, an area for receiving a signature to be authenticated, processing means for supplying dynamic characteristics of the signature to be authenticated, means for comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in the permanent memory in order to produce a validation signal, a temporary memory for storing at least one of the dynamic characteristics of the signature to be authenticated and the validation signal supplied by the comparison means, and means for powering the processing means and/or the comparison means independently of a reader intended to read information from the card.
  2. (Amended) A card according to Claim 1, including a receiving antenna for powering the processing means and/or the comparison means in the card.
  3. (Amended) A card according to Claim 1, including an internal energy source for powering the processing means and/or the comparison means .
  4. (Amended) A card according to Claim 3, wherein the power source is of the piezoelectric and/or pyroelectric type.
  5. (Amended) A card according to Claim 4, including at least one piezoelectric sheet for detecting the dynamic characteristics of the signature to be authenticated, wherein

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said piezoelectric sheet is also used for producing the electrical energy necessary for powering said processing means and/or comparison means.

6. (Amended) A card according to claim 1, wherein the period of storage in the temporary memory of the dynamic characteristics to be authenticated or of the validation signal is at most about one minute.

7. (Amended) A card according to claim 1, wherein said card includes contacts, and the signature area for authentication is distinct from the area of the contacts.

8. (Amended) A card according to claim 1, wherein the signature area has a piezoelectric sheet covered with parallel conductive lines on one face and parallel conductive lines on the other face, with the lines on the two faces being oriented in different directions, and one of the dynamic characteristics comprises the writing pressure at selected points.

9. (Amended) A card according to claim 1, wherein the signature area has two superposed piezoelectric sheets, the upper face of an upper sheet having a set of parallel conductive lines and the lower face of a lower sheet also having a set of lines parallel to one another but in a different direction relative to the conductive lines of the upper sheet, and, in each of these sets of parallel lines, lines of even rank are connected to a first terminal and lines of odd rank are connected to a second terminal.

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10. (Amended) A card according to claim 1, wherein the signature area has two sheets, each of which has parallel conductive lines oriented in different respective directions, that come into contact with one another at the location of a writing stylus.

11. (Amended) A card according to claim 1, further including means for inhibiting at least one function performed within the card, this inhibiting being the result of the comparison between the dynamic characteristics of the signature to be authenticated and the characteristics recorded in permanent memory.

12. (Amended) A device intended for use with a card according to Claim 2, comprising a transmitting antenna for powering the receiving antenna of the card, and a support.

13. (Amended) A circuit for an electronic card, comprising a permanent memory for storing dynamic characteristics of the signature of the holder, processing means having inputs for signals representing a signature and supplying dynamic characteristics of a signature to be authenticated, means for comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory in order to produce a validation signal, a temporary memory for at least one of the dynamic characteristics of the signature to be authenticated and the validation signal supplied by the comparison means, and means for powering the processing means

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and/or the comparison means independently of a reader intended to read information from the card.

**REMARKS**

Entry of the foregoing amendment is respectfully requested. This amendment is intended to place the claims in a more conventional format and eliminate the multiple dependency of the claims.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

By:   
James A. LaBarre  
Registration No. 28,632

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Date: March 7, 2002

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Attorney's Docket No. 032326-200  
Page 1

**Attachment to Preliminary Amendment dated March 7, 2002**

**Marked-up Claims 1 - 13**

1. (Amended) An electronic card [with] comprising a permanent memory in which there are stored [characteristics for identifying the holder of the card, with a view to the comparison of these characteristics with characteristics entered during an authentication sequence, characterised in that,] dynamic characteristics of the signature of [the] a holder [being stored in the permanent memory (26),] of the card, [has] an area [(12)] for [effecting] receiving a signature to be authenticated, [and] processing means [(14)] for supplying dynamic characteristics of the signature to be authenticated, means [of] for comparing [(24)] the dynamic characteristics of the signature to be authenticated with the characteristics recorded in the permanent memory [(26)] in order to produce a validation signal, a temporary memory [(20)] for storing at least one of the dynamic characteristics of the signature to be authenticated [or for] and the validation signal supplied by the comparison means, and means for [allowing the] powering [of] the processing means and/or the comparison means [outside] independently of a reader intended to read information from the card.

2. (Amended) A card according to Claim 1, [characterised in that it has] including a receiving antenna for powering the processing means and/or the comparison means in the card.

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Page 2

**Attachment to Preliminary Amendment dated March 7, 2002**

**Marked-up Claims 1 - 13**

3. (Amended) A card according to Claim 1, [characterised in that it has]  
including an internal energy source for powering the processing means and/or the comparison means .
4. (Amended) A card according to Claim 3, [characterized in that] wherein the power source is of the piezoelectric and/or pyroelectric type.
5. (Amended) A card according to Claim 4, [characterised in that it has]  
including at least one piezoelectric sheet for detecting the dynamic characteristics of the signature to be authenticated, [and in that this] wherein said piezoelectric sheet is also used for producing the electrical energy necessary for [the] powering [of] said processing means and/or comparison means.
6. (Amended) A card according to [any one of the preceding claims,  
characterised in that] claim 1, wherein the period of storage in the temporary memory of the dynamic characteristics to be authenticated or of the validation signal is at most about one minute.
7. (Amended) A card according to [any one of the preceding claims,  
characterised in that,] claim 1, wherein said card [being of the type with] includes contacts,

**Attachment to Preliminary Amendment dated March 7, 2002**

**Marked-up Claims 1 - 13**

and the signature area [(12)] for authentication is distinct from the area [(28)] of the contacts.

8. (Amended) A card according to [any one of the preceding claims, characterised in that] claim 1, wherein the signature area [(12)] has a piezoelectric sheet covered with parallel conductive lines on one face and parallel conductive lines on the other face, with the lines on the two faces [having] being oriented in different directions, and one of the dynamic characteristics [consisting of] comprises the writing pressure at [each point or at] selected points.

9. (Amended) A card according to [any one of Claims 1 to 7, characterised in that] claim 1, wherein the signature area [(12)] has two superposed piezoelectric sheets, the upper face of [the] an upper sheet [(48)] having a set of parallel conductive lines and the lower face of [the] a lower sheet [(50)] also having a set of lines parallel to one another but [with] in a different direction relative to the conductive lines of the upper sheet, and [in that], in each of these sets of parallel lines, [the] lines of even rank are connected to [the] a first terminal [(42; 46)] and [the] lines of odd rank are connected to a second terminal [(40; 44)].

**Attachment to Preliminary Amendment dated March 7, 2002**

**Marked-up Claims 1 - 13**

10. (Amended) A card according to [any one of Claims 1 to 7, characterised in that] claim 1, wherein the signature area [(12)] has two sheets, each of which has parallel conductive lines[, these lines, of] oriented in different respective directions, [coming] that come into contact with one another at the location of a writing stylus.

11. (Amended) A card according to [any one of the preceding claims, characterised in that it has means of total or partial inhibiting of] claim 1, further including means for inhibiting at least one function [or of one means inside this] performed within the card, this inhibiting being [ordered by] the result of the comparison between the dynamic characteristics of the signature to be authenticated and the characteristics recorded in permanent memory.

12. (Amended) A device intended for use with a card according to Claim 2, [characterised in that it has] comprising a transmitting antenna for powering the receiving antenna of the card, and a support.

13. (Amended) A circuit [intended] for an electronic card, [with permanent memory, characterised in that it has] comprising a permanent memory for storing dynamic characteristics of the signature of the holder, processing means having inputs for signals representing a signature and supplying dynamic characteristics of a signature to be

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**Attachment to Preliminary Amendment dated March 7, 2002**

**Marked-up Claims 1 - 13**

authenticated, means [of] for comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory in order to produce a validation signal, a temporary memory [(20)] for at least one of the dynamic characteristics of the signature to be authenticated [or for] and the validation signal supplied by the comparison means, and means for [allowing the] powering [of] the processing means and/or the comparison means [outside] independently of a reader intended to read information from the card.

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ELECTRONIC CARD COMPRISING IN STORAGE  
ITS BEARER'S IDENTIFICATION

The invention relates to an electronic card comprising in storage its bearer's identification.

5 Electronic cards with a memory and/or microprocessor, sometimes referred to as "smart cards", are often personalised, notably for banking applications or access control. The personalisation consists in general of a personal code in the memory of 10 the card and/or data relating to the bearer entered on the card itself, such as a photograph of this bearer or his signature.

The data representing the bearer must, in general, involve a person responsible for the authentication. 15 For example, he compares the signature produced on a separate sheet, such as a payment slip or annotation, with the signature on the card. This check offers a very limited guarantee, on the one hand because of the

risks of error in assessment by the checker and on the other hand because the signatures can be imitated by fraudsters.

Moreover, in order to compare the code in the  
5 memory of the card with the code stored by the bearer,  
it is necessary to have recourse to a reader with a  
keypad and, for the comparison between the code entered  
by the user by means of the keypad and the code in the  
memory of the card, this code must be presented at  
10 output terminals of the card. This presentation of the  
code at the output terminals constitutes a not  
insignificant risk of fraud. In addition, inserting  
the card in a reader constitutes an annoying  
constraint.

15 To avoid the presentation of the code at output  
terminals of the card, it is known that the latter can  
be provided with: a permanent memory containing dynamic  
characteristics of the signature of the bearer, a  
piezoelectric detection zone provided for an  
20 authentication signature, a processing means for  
analysing the signal supplied by the detection zone in  
order to derive therefrom dynamic characteristics of  
the signature to be authenticated and to compare them  
with the characteristics in memory, and means for  
25 supplying an authentication signal according to the  
result of the comparison between the dynamic  
characteristics in memory and the dynamic  
characteristics detected.

It is known that the dynamic characteristics of a  
30 signal are practically inimitable. This is because,

though the geometry of a signature can be imitated relatively easily, the dynamic characteristics of a signature, such as the pressure exerted at each point (or at certain points) on the writing support, the 5 signature time, the speed and acceleration at each point or at given points and changes in direction made when the signature is made are parameters which are practically impossible for a third party to reproduce.

In addition, the technique of detecting the 10 dynamic characteristics of the signature of the bearer requires the use of a memory of moderate capacity and the means used for reading dynamic signature information are simple.

However, such a card makes it necessary to provide 15 the reader with means so that the card bearer can proceed with the signature when the card is inserted in the reader. In other words, the user has available only a fraction of the surface of the card, whose dimensions are intrinsically small, in order to appose 20 his signature. In addition, manipulating the card when the latter is inserted in the reader poses problems which are difficult to resolve, notably with contact cards. This is because manipulating the card to effect 25 signatures may make this card move and therefore alter the connection between the card contacts and a connector in the reader.

The invention remedies these drawbacks.

The card according to the invention is characterised in that it has a means for allowing the 30 power supply of the processing means or of the

comparison means outside a reader intended to read information on the card. Thus the signature can be effected at any point, for example on a support independent of the card reader.

5       The power supply makes it possible either to keep the dynamic characteristics of the signature in memory, or to keep the authentication of this card in memory.

10      In one embodiment, which allows immediate comparison between the dynamic characteristics of the signature effected for authentication and the dynamic characteristics of the signature permanently recorded, the card has a receiving antenna able to be supplied by induction, this antenna supplying with electrical energy a processing circuit and a microprocessor of the card for effecting the comparison.

15      In this embodiment, for the use of the card, recourse is had first of all to a support on which the card is to be placed, this support having a transmitting antenna for the supply by induction of the receiving antenna of the card. Next, if the card is of the contact type, it is inserted in a card reader, which allows validation, or not, according to the result of the authentication and, if the card has been authenticated, its use.

20      In a variant, the card has an energy source such as a battery or accumulator for recording the dynamic characteristics and comparing them, by means of a microprocessor, with the recorded characteristics.

25      In one embodiment, which allows the use of a low-capacity energy source, only the dynamic

characteristics of the signature are recorded but the comparison by means of the microprocessor of the card is effected when the latter is inserted in a reader which supplies to it the energy necessary for the functioning of the microprocessor.

In one embodiment, the electrical energy necessary for the storing of the dynamic characteristics of the signature and/or for the supply to the circuits allowing a comparison of these dynamic characteristics with those in permanent memory in the card, is obtained by means of piezoelectric or pyroelectric means. This embodiment is particularly favourable when the detection of the dynamic characteristics is effected by means of a piezoelectric membrane, for example a sheet 10 of polyvinylidene fluoride. In this case it is, for example, the pressure exerted on this sheet which creates, in addition to the useful signals, the energy necessary for the power supply. It is also possible to use the pyroelectric effect which generally manifests 15 in piezoelectric materials; for this purpose, it is for example possible to provide for the user to press his finger on the card so that the heat thus afforded creates the necessary electrical energy.

For certain applications such as cards which are 20 to be used only once, the dynamic characteristics of the signature and/or the result of the authentication can be kept in memory for a long time.

However, with cards which are to be used several 25 times, as is generally the case, preferably the dynamic characteristics of the signature or the authentication

are kept in the memory of the card for a limited time, for example around one minute. This arrangement is favourable to security in use of the card. This is because, if for example the card is stolen after the 5 authentication signature, the risk of fraudulent use will be reduced. In addition, keeping in memory for a limited time allows the use of technologies which do not make it necessary to provide high electrical energy supplies in the card.

10 For entering the signature with a view to its putting in permanent memory and/or with a view to authentication, there is provided, for example, a sheet 15 of piezoelectric polymer, such as a film of polyvinylidene fluoride, covered on each of its two faces with parallel conductive lines, the lines on the first face having a direction different from the direction of the lines on the other face. Under these circumstances, the surface of the piezoelectric sheet has as many detection points as there crossing points 20 between the conductive lines on the two faces. The pressure exerted on the piezoelectric sheet generates a difference in potential which is detectable at each point on the sheet. The detection grating consisting 25 of the piezoelectric sheet and the conductive lines also makes it possible to easily analyse the various dynamic parameters of the signatures, such as the speed of writing, the accelerations and the changes in direction.

In a variant, which is an easier embodiment, in 30 order to avoid detections at a multiplicity of points,

two superimposed piezoelectric sheets are provided, one being covered on one face with parallel conductive lines and the other sheet also being covered with conductive lines parallel to each other but in different directions, notably perpendicular to the conductive lines applied to the first piezoelectric sheet. However, unlike the previous embodiment, in each sheet the even numbered conductive lines are all connected to the same terminal whilst the odd numbered lines are connected to another terminal. Thus the connection to the dynamic signature analysis circuit is effected only by means of four electrodes. The pressure exerted to produce the signature causes an alternating supply to the terminals which makes it possible to determine, in addition to the pressure exerted at each point, the axis and direction of the movements of the instrument used for effecting the signature.

In another variant, recourse is had to two sheets each having parallel conductive lines on each of the faces and in different directions on the two faces and, when a stylus presses at one point on a face, a conducting line on this face comes into contact with a conducting line on the other face, which causes a short-circuit indicating the passage of the stylus at this point. This variant is of economical design, since it is not necessary to provide a piezoelectric sheet and to measure the difference in potential at each point; however, it does not make it possible to measure the pressure of a stylus or pen. However, it

has been found that, without this parameter, the other dynamic characteristics of the signature make it possible to proceed with the authentication with a sufficient degree of reliability and security against  
5 fraud.

The signature for authentication will be effected with a stylus inscribing nothing permanently on the card or with a pen with erasable ink or a pencil.

The invention also relates to a circuit intended  
10 for an electronic card with a permanent memory, characterised in that it has a permanent memory for the storage of the dynamic characteristics of the signature of the bearer, processing means having inputs for signals representing a signature and supplying dynamic  
15 characteristics of a signal to be authenticated, means of comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory, and means for allowing the supply of electrical energy to the processing means  
20 and/or the comparison means outside a card reader.

This circuit is preferably such that it keeps in memory the signals supplied by the processing means or the signals supplied by the comparison means for a limited time.

25 Other characteristics and advantages of the invention will emerge with the description of some of its embodiments, this being given with reference to the accompanying drawings, in which:

30 Figure 1 is a circuit diagram for a card according to the invention,

Figure 2 is a diagram of a card according to the invention,

Figure 3 is a diagram of the signature detection part of a card for a variant of Figure 1,

5 Figure 4 is a view from above of Figure 3, and

Figure 5 is a view from below of Figure 3.

The example embodiments of the invention which will be described with the figures relate to a rectangular-shaped card having the standard format of a credit card. This card is intended for banking applications and/or for access control.

The card 10 has, on one of its faces, a sheet 10, one face of which is visible to allow an authentication signature. This sheet 10 comprises a piezoelectric polymer covered, on one of its faces, for example the visible face, with conductive lines (not shown in detail) and, on its other face, conductive columns (also not shown). The intersection of the lines and columns forms a grating of points. When a pen or stylus bears on the visible face of the sheet, this pressure creates, at each point, a difference in potential between the line and column concerned and this difference in potential represents the pressure applied. In addition, the grating of points makes it possible to know, at each moment, the position of the tip of the writing stylus.

For analysing the dynamic characteristics of the signature, a conventional processing circuit 14 is provided, having inputs 16<sub>1</sub>, 16<sub>2</sub>, etc., 16<sub>n</sub>, connected to

the conductive lines and inputs  $18_1, 18_2, \dots, 18_p$  connected to the conductive columns.

5 The dynamic characteristics which are taken into account by the circuit 14 are, in addition to the pressure exerted at each point or at selected points, the speed of writing at each point, or at certain points the acceleration, the radial and tangential accelerations, the duration of the signature, and the changes in direction (the angles) of the signature.

10 These dynamic characteristics supplied by the processing circuit 14 are introduced into a temporary memory 20.

15 The data of the memory 20 are applied to inputs 22 of a microprocessor 24 having, in a permanent memory 26, the pre-recorded dynamic characteristics of the signature of the bearer. This microprocessor 24 is, in a conventional manner, able to be connected by contacts 28, such as those corresponding to ISO 7816, to a card reader with contacts. The contacts 28 are situated on 20 the face of the card 12 which is opposite to the face on which the signature sheet 12 is situated.

25 The sheet 12 is, for example, disposed in the zone normally provided for the signature on credit cards (Figure 2). In other words, it is not necessary to provide a supplementary space in addition to those provided on credit cards.

In the embodiment depicted in Figures 3, 4 and 5, in order to avoid the large number ( $n + p$ ) of connections of the sheet 12 to the circuit 14, only

four connections 40, 42, 44 and 46 are provided (Figures 4 and 5).

In order to obtain this result, the sheet 12 has two piezoelectric membranes 48 and 50. On the top face 48<sub>1</sub> of the sheet 48, a double grating 52 of parallel lines is provided, depicted in Figure 4. The lines in this grating are, in this example, along the width of the sheet 12. These lines are equidistant. They are grouped together in two subsets: the first subset comprises the lines 54<sub>1</sub>, 54<sub>3</sub>, etc, odd in number, and the second subset comprises the lines 54<sub>2</sub>, 54<sub>4</sub>, etc, even in number. The lines in the first subset are all connected to the terminal 40 whilst the lines in the second subset are all connected to the terminal 42.

The second piezoelectric sheet 50 has, on its bottom face 50<sub>1</sub>, the grating 56 depicted in Figure 5, which is similar to the grating 52 depicted in Figure 4 but in a direction at right angles. In other words, the lines 58 in the grating 56 are parallel to each other and along the length of the sheet 12. The lines 58<sub>1</sub>, 58<sub>3</sub>, etc of odd rank are connected to the terminal 44 whilst the lines 58<sub>2</sub>, 58<sub>4</sub>, etc of even rank are connected to the terminal 46.

The bottom face of the membrane 48 is covered by an earthed electrode 60 (Figure 3). Likewise, the top face of the piezoelectric membrane 50 is covered with a metallic electrode connected to earth.

In order to be able to correctly distinguish the direction of movement of the writing stylus, in each grating, 52, 56, provision is made for the distance

from an electrode with a rank of a given parity to the following electrode of the other parity to be substantially different from the distance separating this last electrode from the following electrode in the first parity. For example, an odd electrode is followed by an even electrode at a distance D1, whilst the distance D2 separating this even electrode from the following electrode of odd rank is at a distance D2 greater than D1. For example, the distance separating the electrodes 54<sub>3</sub> and 54<sub>2</sub> is substantially greater than the distance separating the electrodes 54<sub>3</sub> and 54<sub>4</sub>, and so on. In this way, when the stylus moves from left to right, the shortest distance between two time pulses corresponds to a first signal at the terminal 40 and a second signal at the terminal 42. In the contrary case, that is to say for a movement from right to left, the shortest distance in time corresponds to a signal which appears first of all at the electrode 42 and then at the electrode 40.

The combination of data supplied by the two piezoelectric membranes supplies information on the axis and direction of movement of the stylus effecting the signature, the two piezoelectric sheets also supply information on the pressure. The axis and direction are obtained by determining the times of appearance of the signals at the terminals 40 and 42 and at the terminals 44 and 46. The direction is a function of the order of appearance of the signals at the terminals 40 and 42 and at the terminals 44 and 46. These

signals also supply information on the speed and acceleration.

With respect to the embodiment depicted in Figure 1, the example shown in Figures 3, 4 and 5 does not provide any information about the position of the signature on the sheet 12. However, this information is of little significance for identifying the dynamic characteristics of the signature.

According to an important provision of the invention, supply means are provided allowing the temporary functioning of the processing circuit 14 and possibly of the microprocessor 24 in order to permit the recording of the dynamic characteristics of the signature and/or the supply of an authorisation signal, independently of a reader in which the card 10 is subsequently to be introduced. In this way, the bearer of the card can sign, without constraint, on any support or on an adapted support.

To this end, in one embodiment (not shown), the card has a receiving antenna intended to be supplied with electrical energy by induction by means of a sending antenna, and the antenna of the card supplies the circuits 14 and 24 with electrical energy. In this embodiment, the reading means (not shown) have two parts, namely on the one hand a support with the sending antenna, on which the user can effect his signature for authentication, and on the other hand the reader proper for reading the contact card 26.

In this case, the comparison is effected after the effecting of the signature, and the memory 20

automatically empties at the end of the comparison. On the other hand, the authentication signal is kept in an appropriate memory of the microprocessor 24.

5 This keeping of the authentication signal in the memory of the microprocessor 24, or in another memory, is preferably effected over a limited length of time, for example 30 seconds or one minute, so that the card cannot be used fraudulently when it is a card which is to be used several times.

10 This last characteristic, according to which the authentication signal must be kept for a limited length of time in memory, applies whatever the supply mode used for the circuits 14 and/or 24. It also applies in the case where other supply means are provided as 15 described below.

15 It should also be noted that, whatever the type of supply, the dynamic characteristics of the signature are kept in the temporary memory 20 only for a sufficient length of time for the comparison with the 20 characteristics recorded in the memory 26. After this comparison, the microprocessor 24 supplies an authorisation or invalidation signal.

The memory 20 is a random access memory. The temporary keeping of the information consists, in one 25 example, of providing a timing means, for example controlled by an internal clock or by the discharge of a capacitor, and proceeding with an erasure of the content of the memory 20 after the elapse of the prescribed time.

Likewise, when the authorisation signal is kept temporarily, a means is also provided for erasing this authorisation signal after the lapse of a time determined by a timing means such as a clock or the discharge of a capacitor.

According to yet another embodiment, the card 10 has its own supply source so as to allow the storage in memory of the dynamic characteristics of the signature and/or of the authentication, outside a reading appliance. This internal source consists, for example, of a battery or accumulator. To minimise the power of the energy source, it is preferable for this to be provided only for the functioning of the processing circuit 14 but not for the functioning of the microprocessor 24. In this case, the dynamic characteristics of the signature are kept in the temporary memory 20, preferably for a limited length of time as indicated above. The authentication is effected next when the card is introduced into an appropriate reader which allows the supply of the microprocessor 24.

For the supply, recourse can also be had to a piezoelectric sheet, for example the piezoelectric sheet or sheets provided for the zone 12.

The energy can also be provided by pyroelectric effect. In this case, it is preferable to use, for detecting the dynamic characteristics of the signature, a piezoelectric sheet which also has pyroelectric characteristics.

For the use of the pyroelectric effect, in one example a zone of the card is reserved on which a finger is pressed and the heat afforded by the pressure of the finger produces the electrical energy necessary  
5 for the functioning of the circuit 14 and/or of the microprocessor 24.

It should be noted that the invention is compatible with a card which can be validated by its identification number, the combination of a validation  
10 by the signature and by the identification number constituting great security against fraudulent use of the card.

It will also be noted that the invention encompasses the combined use of the dynamic and static,  
15 that is to say geometric, characteristics of the signature for authenticating the card.

Whatever the embodiment, the signal resulting from the comparison of the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory may or may not make it possible to pursue a transaction with an apparatus such as a card reader. For example, a reader may, in the context of a dialogue with the card, find, during an authorisation period, the validation information in a temporary memory of the card and pursue the transaction  
25 after the elapse of this authorisation period.

According to one embodiment, the validation signal is capable of causing the total or partial inhibition of one of the functions, or means, of the card, for example the inhibition of a response to a mutual  
30

recognition signal or the inhibition of an application, in the case of a multiapplication card.

For this purpose the card has, in this embodiment, means of total or partial inhibition of functions or 5 means of this card. The inhibition, or blocking, may be triggered after several fruitless validations. Unblocking means may be provided as an option.

The signal resulting from the said comparison makes possible, in one embodiment, the opening of a 10 dialogue with a reader and the pursuit of its functioning, for example by virtue of a logic gate situated in the card circuits, this card opening or closing an electrical contact in connection with the contact areas on the card, or with a communication 15 interface.

The keeping of the logic gate in the open position may be relayed by the reader, once the dialogue has been established, in spite of the expiry of the authorisation period.

CLAIMS

1. An electronic card with a permanent memory in which there are stored characteristics for identifying the holder of the card, with a view to the comparison of these characteristics with characteristics entered during an authentication sequence, characterised in that, dynamic characteristics of the signature of the holder being stored in the permanent memory (26), the card has an area (12) for effecting a signature to be authenticated, and processing means (14) for supplying dynamic characteristics of the signature to be authenticated, means of comparing (24) the dynamic characteristics of the signature to be authenticated with the characteristics recorded in the permanent memory (26) in order to produce a validation signal, a temporary memory (20) for the dynamic characteristics of the signature to be authenticated or for the validation signal supplied by the comparison means, and means for allowing the powering of the processing means and/or the comparison means outside a reader intended to read information from the card.

2. A card according to Claim 1, characterised in that it has a receiving antenna for powering the processing means and/or the comparison means in the card.

25  
3. A card according to Claim 1, characterised in that it has an internal energy source for powering the processing means and/or the comparison means.

4. A card according to Claim 3, characterised in that the power source is of the piezoelectric and/or pyroelectric type.

5. A card according to Claim 4, characterised in that it has at least one piezoelectric sheet for detecting the dynamic characteristics of the signature to be authenticated, and in that this piezoelectric sheet is also used for producing the electrical energy necessary for the powering of processing means and/or comparison means.

10 6. A card according to any one of the preceding claims, characterised in that the period of storage in the temporary memory of the dynamic characteristics to be authenticated or of the validation signal is at most about one minute.

15 7. A card according to any one of the preceding claims, characterised in that, said card being of the type with contacts, the signature area (12) for authentication is distinct from the area (28) of the contacts.

20 8. A card according to any one of the preceding claims, characterised in that the signature area (12) has a piezoelectric sheet covered with parallel conductive lines on one face and parallel conductive lines on the other face, the lines on the two faces having different directions, one of the dynamic characteristics consisting of the writing pressure at each point or at selected points.

25 9. A card according to any one of Claims 1 to 7, characterised in that the signature area (12) has two

superposed piezoelectric sheets, the upper face of the upper sheet (48) having parallel conductive lines and the lower face of the lower sheet (50) also having lines parallel to one another but with a different direction to the conductive lines of the upper sheet, and in that, in each of these sets of parallel lines, the lines of even rank are connected to the first terminal (42; 46) and the lines of odd rank are connected to a second terminal (40; 44).

10. 10. A card according to any one of Claims 1 to 7, characterised in that the signature area (12) has two sheets, each of which has parallel conductive lines, these lines, of different directions, coming into contact with one another at the location of a writing stylus.

15. 11. A card according to any one of the preceding claims, characterised in that it has means of total or partial inhibiting of at least one function or of one means inside this card, this inhibiting being ordered by the result of the comparison between the dynamic characteristics of the signature to be authenticated and the characteristics recorded in permanent memory.

20. 12. A device intended for use with a card according to Claim 2, characterised in that it has a transmitting antenna for powering the receiving antenna of the card, and a support.

25. 13. A circuit intended for an electronic card with permanent memory, characterised in that it has a permanent memory for storing dynamic characteristics of the signature of the holder, processing means having

inputs for signals representing a signature and supplying dynamic characteristics of a signature to be authenticated, means of comparing the dynamic characteristics of the signature to be authenticated with the characteristics recorded in permanent memory in order to produce a validation signal, a temporary memory (20) for the dynamic characteristics of the signature to be authenticated or for the validation signal supplied by the comparison means, and means for allowing the powering of the processing means and/or the comparison means outside a reader intended to read information from the card.

(12) DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITÉ DE COOPÉRATION  
EN MATIÈRE DE BREVETS (PCT)

(19) Organisation Mondiale de la Propriété  
Intellectuelle  
Bureau international



(43) Date de la publication internationale  
15 mars 2001 (15.03.2001)

PCT

(10) Numéro de publication internationale  
**WO 01/18757 A1**

(51) Classification internationale des brevets<sup>7</sup>: G07F 7/10, G06K 19/077, G07C 9/00

(71) Déposant (pour tous les États désignés sauf US): GEM-PLUS [FR/FR]; Avenue du Pic de Bertagne, Zone d'Activités de Gémenos, F-13881 Gémenos (FR).

(21) Numéro de la demande internationale:

PCT/FR00/02380

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(22) Date de dépôt international: 25 août 2000 (25.08.2000)

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(25) Langue de dépôt:

français

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(26) Langue de publication:

français

(30) Données relatives à la priorité:

99/11399

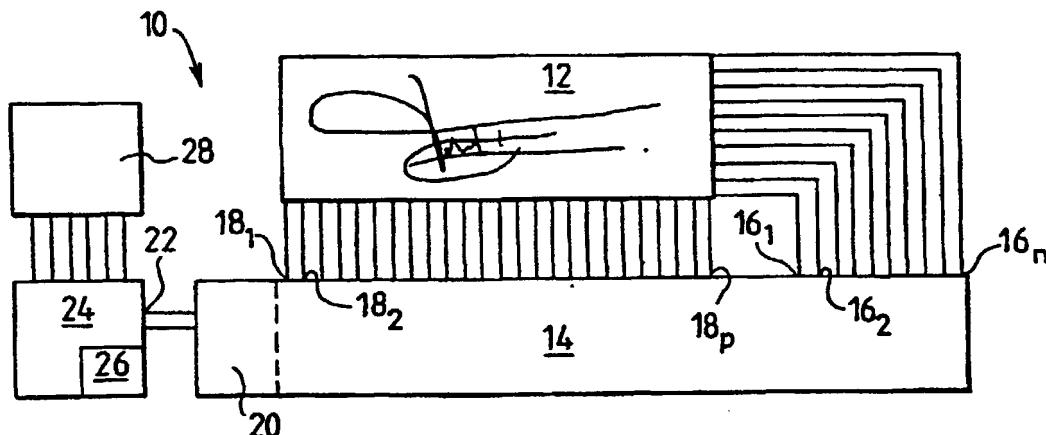
7 septembre 1999 (07.09.1999) FR

(81) États désignés (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE,

[Suite sur la page suivante]

(54) Title: ELECTRONIC CARD COMPRISING IN STORAGE ITS BEARER'S IDENTIFICATION

(54) Titre: CARTE ELECTRONIQUE COMPORTANT EN MEMOIRE UNE IDENTIFICATION DE SON TITULAIRE



**WO 01/18757 A1**  
(57) Abstract: The invention concerns an electronic card with non-volatile storage wherein are stored the card bearer's identification characteristics, for comparison of said characteristics with characteristics introduced during an authenticating sequence. Dynamic signature characteristics of the bearer are stored in the non-volatile storage (26). The card further comprises a zone (12) for producing a signature to be authenticated, and processing means (14) for supplying dynamic characteristics of the signature, means for comparing (24) the signature dynamic characteristics with the characteristics recorded in the non-volatile storage (26), and means for powering the processing means and/or the comparing means outside a reader designed for reading data in the card.

(57) Abrégé: L'invention concerne une carte électronique à mémoire permanente dans laquelle sont stockées des caractéristiques d'identification du titulaire de la carte, en vue de la comparaison de ces caractéristiques avec des caractéristiques introduites lors d'une séquence d'authentification. Des caractéristiques dynamiques de la signature du titulaire sont stockées dans la mémoire permanente (26). La carte comporte aussi une zone (12) pour la réalisation d'une signature à authentifier, ainsi que des moyens de traitement (14) pour fournir des caractéristiques dynamiques de la signature avec les caractéristiques dynamiques de la signature, des moyens de comparaison (24) des caractéristiques enregistrées

[Suite sur la page suivante]

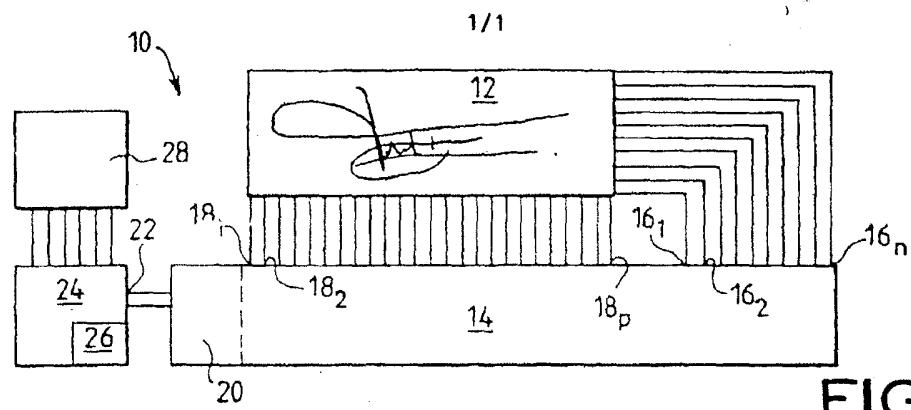


FIG.1

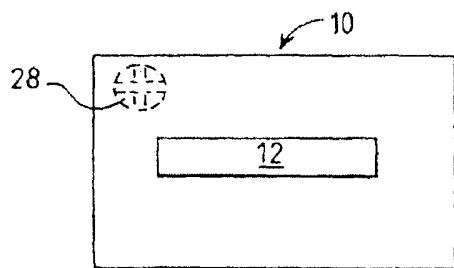


FIG.2

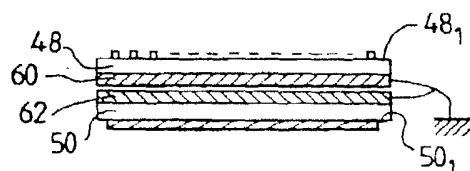


FIG.3

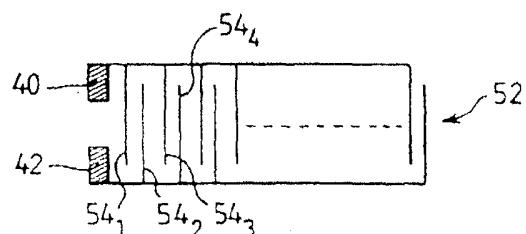


FIG.4

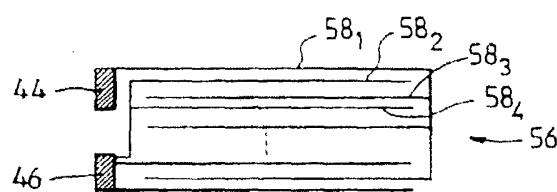


FIG.5

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY  
(Includes Reference to Provisional and International (PCT) Applications)**

Attorney's Docket No.  
Nº. GEM 732

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;  
I BELIEVE I AM THE ORIGINAL, FIRST AND SOLE INVENTOR (IF ONLY ONE NAME IS LISTED BELOW) OR AN  
ORIGINAL, FIRST AND JOINT INVENTOR (IF PLURAL NAMES ARE LISTED BELOW) OF THE SUBJECT MATTER  
WHICH IS CLAIMED AND FOR WHICH A PATENT IS SOUGHT ON THE INVENTION ENTITLED:

ELECTRONIC CARD COMPRISING IN STORAGE ITS BEARER'S IDENTIFICATION

The specification of which (check only one item below):

- is attached hereto.
- was filed as United States Patent Application Number \_\_\_\_\_  
on \_\_\_\_\_  
and was amended on \_\_\_\_\_ (if applicable).
- was filed as International (PCT) Application Number PCT/FR00/02380  
on August 25<sup>th</sup> 2000  
and was amended on \_\_\_\_\_ (if applicable).

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-IDENTIFIED SPECIFICATION,  
INCLUDING THE CLAIMS, AS AMENDED BY ANY AMENDMENT REFERRED TO ABOVE.

I ACKNOWLEDGE THE DUTY TO DISCLOSE TO THE U.S. PATENT AND TRADEMARK OFFICE ALL INFORMATION  
KNOWN TO ME TO BE MATERIAL TO PATENTABILITY AS DEFINED IN TITLE 37, CODE OF FEDERAL  
REGULATIONS, Sec. 1.56 (as amended effective March 16, 1992);

I do not know and do not believe the said invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to said application; that said invention was not in public use or on sale in the United States of America more than one year prior to said application; that said invention has not been patented or made the subject of an inventor's certificate issued before the date of said application in any country foreign to the United States of America on any application filed by me or my legal representatives or assigns more than six months prior to said application;

I hereby claim foreign priority benefits under Title 35, United States Code, §§ 119 (a)-(e) of any foreign application(s) for patent or inventor's certificate or of any International (PCT) Application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT International (PCT) Application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. §119:**

| COUNTRY<br>(if PCT, indicate "PCT") | APPLICATION NUMBER | DATE OF FILING<br>(day, month, year) | PRIORITY CLAIMED<br>UNDER 35 U.S.C. §119                            |
|-------------------------------------|--------------------|--------------------------------------|---|
| FRANCE                              | FR / 99 11399      | 07/09/1999                           | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
| PCT                                 | PCT/FR00/02380     | 28/08/2000                           | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No |
|                                     |                    |                                      | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
|                                     |                    |                                      | <input type="checkbox"/> Yes <input type="checkbox"/> No            |
|                                     |                    |                                      | <input type="checkbox"/> Yes <input type="checkbox"/> No            |

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

(APPLICATION NUMBER)

(FILING DATE)

(APPLICATION NUMBER)

(FILING DATE)

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)**  
**(Includes Reference to Provisional and International (PCT) Applications)**

Attorney's Docket  
N°. GEM732

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States applications(s) or International (PCT) Application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations § 1.56, which became available between the filing date of the prior application(s) and the national or international filing date of this application:

PRIOR U.S. APPLICATIONS OR INTERNATIONAL (PCT) APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120:

I hereby appoint the following attorneys and agent(s) to prosecute said application and to transact all business in the U.S. Patent and Trademark Office connected therewith and to file, prosecute and to transact all business in connection with international applications directed to said invention:

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21839

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21839

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (CONT'D)**  
 (Includes Reference to Provisional and International (PCT) Applications)

Attorney's Docket No.  
 N°. GEM732

|   |  |   |                  |
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| FULL NAME OF FIFTH JOINT INVENTOR, IF ANY   |  | SIGNATURE   | DATE             |
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| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |
| FULL NAME OF SIXTH JOINT INVENTOR, IF ANY   |  | SIGNATURE   | DATE             |
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| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |
| FULL NAME OF SEVENTH JOINT INVENTOR, IF ANY   |  | SIGNATURE   | DATE             |
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| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |
| FULL NAME OF EIGHTH JOINT INVENTOR, IF ANY  |  | SIGNATURE   | DATE             |
| RESIDENCE (CITY & STATE/COUNTRY)  |  | CITIZENSHIP   |                  |
| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |
| FULL NAME OF NINTH JOINT INVENTOR, IF ANY   |  | SIGNATURE   | DATE             |
| RESIDENCE (CITY & STATE/COUNTRY)  |  | CITIZENSHIP   |                  |
| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |
| FULL NAME OF TENTH JOINT INVENTOR, IF ANY   |  | SIGNATURE   | DATE             |
| RESIDENCE (CITY & STATE/COUNTRY)  |  | CITIZENSHIP   |                  |
| POST OFFICE ADDRESS (HOME ADDRESS)  |  |   |                  |